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Information Security Model for Evaluating the Competence of Preschool Teachers Using Data Mining Technology

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Abstract:

Kindergarten is an important part of basic education. Creating high-quality early childhood education and promoting the healthy growth of young children need to be achieved through teachers. Kindergarten teachers' core literacy is the basic professional literacy that kindergarten teachers should possess, which is an important foundation for ensuring the quality of kindergarten teachers' teaching and is the key and prerequisite for developing children's core literacy. Through the construction of teacher competency based on children's core literacy and the curriculum of teacher education based on teachers' core literacy, we try to promote the progress of kindergarten teachers, optimize the construction of kindergarten teachers, promote the quality and competence of kindergarten teachers, and lay the foundation for ensuring the quality of preschool education by continuously strengthening the training and cultivation methods of kindergarten teachers. Therefore, the demand for high-quality early childhood education will eventually translate into the demand for teachers. Adopting a scientific approach to assess the competence of preschool teachers can help improve the teaching and research ability of preschool teachers and the overall level of early childhood teaching and learning. In order to improve the shortcomings of traditional preschool teachers' teaching quality assessment in which the weights of each index are susceptible to human influence, based on the study of index coefficient analysis, feature reorganization and feature analysis, this paper constructs a model for evaluating preschool teachers' educational competence in a big data environment and proposes to establish an evaluation scheme for preschool teachers' educational competence based on data mining technology. The simulation results further verify the superiority of the proposed model in improving the evaluation of preschool teachers' educational competence.

Keywords: Data mining techniques, Preschool teachers, Competency Assessment, Deep Learning; Information Security Model

1.INTRODUCTION

With the increasing importance attached to early childhood education by society, this has also put forward higher requirements on the professional competence and professional level of preschool teachers. In this context, the comprehensive business competence of preschool teachers is very important [1-3]. As one of the important positions for preschool teachers' output, higher education institutions comprehensively build the vocational skills of kindergarten teachers' talents. Music teaching ability, as one of the most basic abilities of preschool teachers, has an important influence on the development of preschool education for young children. Therefore, higher vocational colleges and universities should do a good job of shaping the music teaching ability of preschool teachers according to the development of the professional quality requirements of kindergarten teachers, so that they can meet the high standards of kindergarten teachers and escort the good development of preschool music initiation education for young children [4-6]. The professional literacy competencies of preschool teachers and the paths to enhance them are shown in Figure 1.

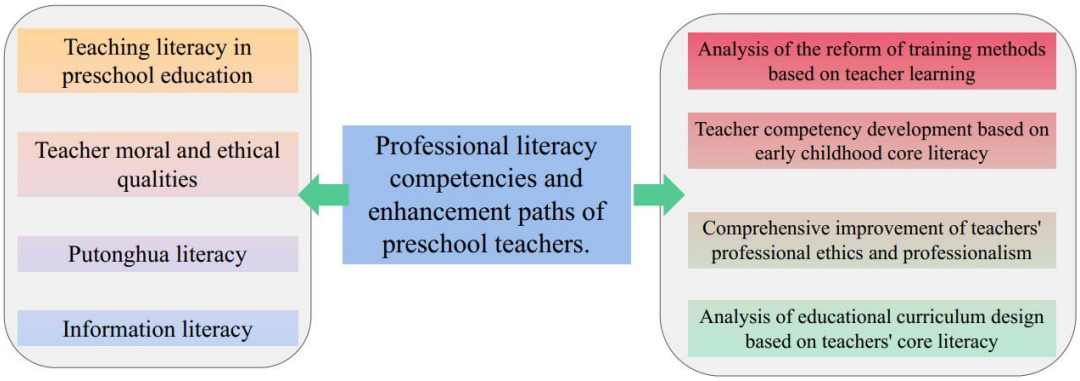

Figure 1 Preschool teachers' professional literacy skills and paths of improvement

The assessment of the core literacy of kindergarten teachers cannot be done without the support of the curriculum, and the basic setting of the current preschool curriculum enables the basic knowledge structure and the range of competencies of kindergarten teachers to be grasped [7-10]. At this stage, many kindergartens, both public and private, have problems with overly broad goals, unscientific structures, unreasonable content, incomplete educational evaluation, and imperfect curriculum systems in their teaching curriculum settings, so these problems should be combined in the reform process to promote the effective assessment of core literacy in the curriculum. The relationship between subject matter literacy, core literacy and curriculum should be correctly handled. To promote the penetration of teachers' core literacy in the curriculum, we must accelerate the construction of the curriculum system, improve the curriculum teaching standards, develop a strict and standardized assessment system for the curriculum, promote the threshold of teachers' entry into the profession, and ensure the overall quality and ability of the teacher team.

Preschool teachers face a very special teaching group. Young children are innocent, lively, and active, full of curiosity and exploration of music, and very much like to participate in music activities. Therefore, every action of preschool teachers in the music teaching classroom has an important influence on young children's interest in music learning and comprehensive ability development. Thus, in the introductory stage of music teaching ability cultivation for preschool kindergarten teachers, higher education institutions should guide students to establish accurate career goals and form correct concepts of early childhood music teaching through correct teaching methods [11-13].

First, preschool students should be guided to analyze young children's interest and attitude towards music learning, and then to create a lively music teaching classroom with rich music teaching methods. In this way, preschool education students in higher education institutions will understand that in their own future development of early childhood music enlightenment teaching, they should take the interest of young children in music learning as the teaching entry point and improve the quality of young children as the goal of teaching development. In addition, music teaching is not only a kind of art education, but also emotional education, aesthetic education, and moral education. Therefore, the functions of early childhood music education are diversified and multifaceted. Students of preschool education in higher education institutions should realize that music teaching is a kind of teaching method with far-reaching value and shaping talent in early childhood teaching activities, which can make young children's expressive power be presented in all aspects. Therefore, the music teaching activities organized by preschool teachers should stimulate young children's interest in exploring the art of music, deeply feel the charm of the art of music, and allow them to form rich musical concepts and practical skills [14]. At the same time, with the continuous development of enlightenment education, the cultivation of preschool teachers' music teaching ability in preschool education majors in higher education institutions should not only pay attention to the shaping of preschool teachers' professional outlook, but also be forward-looking and developmental in terms of teaching philosophy, so as to apply the most cutting-edge music teaching concepts to future music teaching activities for young children, and bring into play the role of early childhood music education for young children's physical and mental development and quality training .

Preschool teachers are the first teachers' children meet for knowledge learning, so preschool teachers have an important role in children's initiation and later growth. Therefore, in the development of music teaching in

preschool education, higher education institutions should carry out comprehensive music teaching skills shaping for the professional requirements of preschool teachers and actively guide young children. In the organization and implementation of kindergarten music teaching activities, preschool teachers should not only teach music according to the syllabus, but also integrate modern means of teaching music to young children, to build a lively classroom for teaching music to young children. Based on this, in the expansion of music teaching skills of preschool education majors in higher education institutions, it is necessary to start from the perspective of comprehensiveness, so that preschool teachers can master music teaching skills in line with job requirements. For example, preschool education students in higher education institutions should master the skills of creating early childhood dances to be able to complete kindergarten dance teaching activities in their future preschool education teaching positions, so that students can improve their comprehensive literacy in colorful dance performances [15-16].

In the specific teaching session of early childhood dance, preschool teachers should not only create dance and start dance teaching according to the physical and mental characteristics and physical movement features of young children, but also sublimate the art of early childhood dance teaching with rich creative ideas, so that the dance of young children can be more prominent with spiritual, lively, and interesting colors, and make young children love the dance class. Therefore, in the process of building music teaching skills of preschool teachers, preschool education majors in higher education institutions should balance the music teaching ability of preschool teachers, so that preschool teachers can master various music teaching skills related to young children's dance creation, children's song playing and singing, and music games, etc., and organize young children's music teaching activities with comprehensive music knowledge and skills literacy. Therefore, in the music curriculum of preschool education majors in higher education institutions, special contents should be added to meet the needs of early childhood music teaching positions and to achieve targeted and specific professional competence training for preschool teachers [17].

With the expansion of kindergartens, the number of preschool teachers in demand has increased. However, there are differences in the teaching quality of preschool teachers, and accurate assessment of teachers' teaching abilities is needed to improve preschool teachers' teaching abilities in a targeted manner. Assessment is typically based on four broad categories of criteria: teaching, research, academic programs, and supporting organizational facilities and services, which form the main pillars of academic quality [18-19]. The central issue in the academic assessment process is the assessment of the quality of the individual course/teacher's teaching by the students enrolled in the course. In the traditional model, preschool teachers' educational competencies are evaluated by developing teaching evaluation forms, reviewing teaching materials, observing classroom teaching, and discussing evaluation results. To derive assessment results, it is inevitable that weights need to be assigned to certain attributes (variables/indicators). By changing the relative weights, it is possible to increase or decrease the importance of certain attributes, which have a crucial impact on the outcome of the assessment process.

In this case, the assessment process itself becomes unreliable and easily subject to subjective factors. In the large online open course environment, preschool teachers' teaching ability evaluation is characterized by openness and randomness, etc. Therefore, quantitative mathematical model analysis methods are needed to accurately assess preschool teachers' educational ability, such as evaluation and prediction of preschool teachers' educational ability through intelligent algorithms and big data processing techniques. The improvement of preschool teachers' teaching ability in the Internet environment was studied, and effective countermeasures for the improvement of preschool teachers' teaching ability were proposed in four dimensions: correct perception of teaching ability, active participation in professional training, comprehensive innovation of teaching mode, and good post-class reflection. The blended teaching model for preschool education constructs a blended learning management system for preschool education from three major elements: teaching subjects, teaching resources and teaching implementation, and carries out teaching design, teaching implementation and teaching evaluation based on this system. Most of the above methods are based on qualitative analysis, and the analysis results are not highly refined.

2.RELATED WORK

2.1.Core Literacy of Preschool Teachers

In the process of deepening reform of preschool education in China, the quality of the early childhood teacher workforce has drawn attention to the fact that the overall capacity of the current kindergarten teacher workforce needs to be improved, and the quality and quality of kindergarten teachers has become an important factor affecting the quality of preschool education and the healthy physical and mental development of young children. As far as the current professional development of kindergarten teachers is concerned, there is a continuous transformation, and the teaching profession has started to move from discipline to integration, with the emergence of five major fields, in terms of value orientation, from professional to humanistic, and in terms of development, from knowledge to competence, all of which are based on changes in the goals of preschool education [20-23].

Based on the training goals of core literacy, it is necessary to take a fresh look at the career and professional development of early childhood teachers, to promote early childhood teachers to cope with social life, and to promote the comprehensive and professional development of kindergarten teachers. As far as preschool education is concerned, the overall level of teacher construction is not high, and the overall quality and professional development of kindergarten teachers has much to be improved. In terms of the professional needs of kindergarten teachers at this stage, the professionalism of kindergarten teachers is mainly reflected in the following aspects: the quality structure of kindergarten teachers; the professional quality structure of kindergarten teachers oriented to the development of competence; and the definition of the professional quality of kindergarten teachers based on professional development.

The quality of kindergarten teachers' group contains various aspects, including ideological and moral quality, cultural quality, psychological quality of personality, physical quality, and educational skills. Based on the current development trend of domestic preschool education and the development direction of teacher specialization, it is argued that the professionalism of kindergarten teachers should contain six aspects, pointing out that as kindergarten teachers in the new era, they should have basic leadership and organizational skills, and should have the ability to learn professionally, the ability to organize education, the ability to create an environment, and the ability to know and understand young children correctly. Based on the analysis from the perspective of professional development of kindergarten teachers, the core qualities of kindergarten teachers should be teachers' research ability and quality, understanding of early childhood education, effective implementation of education and teaching work, and criticism and reflection on their own teaching work [24].

Based on the summary of relevant studies, it is concluded that in the new era, as a kindergarten teacher, the professional literacy should contain the following aspects. Teaching literacy in different subjects is the basic professional literacy of kindergarten teachers, which is the basic content of pre-service education for teachers. The training of teaching literacy in preschool education is conducive to teachers' giving full play to their strengths in teaching professional courses and achieving teaching goals. The quality of teacher morality and style is the most important professional quality of kindergarten teachers at present, and good teacher morality and style is the prerequisite for teachers to serve. At this stage, bad teacher moral and teacher style incidents often trigger strong social repercussions, and the concern of teacher moral and teacher style becomes more fervent, and only kindergarten teachers with good teacher moral and teacher style can teach excellent talents. In recent years, often seen in various reports, kindergarten teachers to children in various disguised corporal punishment, these events in the delivery of a message that there is a small group of kindergarten teachers, teacher ethics and teacher style construction problems, but also pointed out that the current preschool education field, teacher ethics and teacher style construction work lagging behind, these events bring a bad social impact, the image of kindergarten teachers will also have a significant impact.

As a kindergarten teacher, good teacher ethics is a basic and fundamental requirement, and the lack of this is incompetent. Mandarin, as the standard language of China, is one of the basic skills kindergarten teachers need to master. The level of kindergarten teachers' Mandarin needs to be improved, especially some rural and mountainous kindergarten teachers, the rate of teaching Mandarin is not high, many areas use dialects to teach, and some minority kindergarten teachers even use minority languages to teach. With the introduction of the new curriculum standards, Mandarin has become one of the basic professional qualities that kindergarten teachers need to possess. An excellent kindergarten teacher should not only have Mandarin literacy, but also some foreign language skills

so that he or she can do a good job of language initiation and guidance. At this stage, education informatization is still developing, and mastering informatization teaching ability becomes one of the basic professional qualities of kindergarten teachers in the new era. In the development of kindergarten teaching informatization, teacher informatization quality training is the key. In this regard, it is necessary to strengthen information technology literacy training in pre-service education of kindergarten teachers [25].

2.2.Preschool teachers' competency assessment

Core literacy is not only concerned with what competencies kindergarten teachers have, but also with whether kindergarten teachers can apply their competencies in teaching practice. The assessment of kindergarten teachers should focus based on practice, on the assessment of the full range of qualities and abilities of kindergarten teachers, on enabling teachers to adapt to complex and changing early childhood education contexts, and on promoting effective practice of kindergarten teachers. Therefore, it is necessary to strengthen the professional development of kindergarten teachers, continuously innovate teaching concepts, assess professionalism, and promote comprehensive quality improvement [26-28].

Core literacy assessment requires a practical basis and is also a reflection of the teaching ability for kindergarten teachers. To assess the professional competence of kindergarten teachers based on core literacy and to build the competence system of kindergarten teachers' groups, we need to focus on kindergarten teachers' grasp of core literacy assessment of young children, strengthen kindergarten teachers' understanding and observation ability, education and teaching reflective feedback ability, etc. At present, the assessment of kindergarten teachers in China focuses more on theoretical knowledge and skill learning, and not enough on the assessment of innovative thinking in teaching methods. To study the professional development of kindergarten teachers' team, we need to continuously strengthen teaching concepts, skills, and methods so that kindergarten teachers can apply what they have learned to solve the problems they encounter in teaching and strengthen the assessment of kindergarten teachers' team with the goal of core literacy assessment. In teaching, kindergarten teachers need to study preschool education materials, learn art, music, dance and other skills, choreograph children's dances, create music, etc., and promote the overall development of children. In teaching activities, kindergarten teachers also need to organize a variety of practical exercise activities for children, promote children's learning and improvement in play, and continuously promote the optimization of teaching.

The establishment of preschool teachers' competence evaluation model should be based on preschool academic evaluation standards. Preschool academics should have openness, be open to peer evaluation, and be able to communicate and share. The evaluation model we designed includes three sections of preschool education attitude, preschool education competence (covering elements of teachers' curriculum development and preschool education implementation competence), and scholarship and development (covering teachers' academic competence, academic communication competence, and innovation competence), covering the above criteria. The preschool-type teacher evaluation was transformed into a classification question. In the learning phase of the classification problem, a decision tree model is built based on the loss function minimization principle using the training data [29-30]. The random forest method can be used to analyze and rank the importance of different features after one evaluation, delete the unimportant features, and realize the iteration and optimization of the feature system. By ranking the importance of indicators, the feature system is reconstructed, and finally the key features are obtained, and then a preschool education-oriented teacher feature system with preschool education academic-related competencies as the core is obtained by process construction.

In early research work, only multimodal contents are usually modeled separately for use. Text and images are first modeled to extract high-level image features, which are then fed into an LSTM to generate captions for the images. The competence assessment algorithm of preschool teachers based on graph convolutional neural networks is used to assess the competence of preschool teachers with the help of the representation learning ability of graph convolutional networks. The pictures are queried several times using an attention mechanism to gradually infer the competency assessment results of preschool teachers. However, these works do not consider the guiding meaning of pictures for text feature extraction and the association between the two. To analyze the semantic correlations between multimodal contents, a heterogeneous attention-based model for assessing preschool teachers' competencies based on the fusion of pictures and texts is proposed, which both reinforces the common information across modalities and considers the complementarity between different modal difference information.

Since the co-attentive mechanism can consider the influence of both text and pictures on preschool teachers' competency assessment results, the association modeling of text and pictures using the co-attentive mechanism is used to study the competency assessment of preschool teachers based on multimodal content through a classification approach.

In keyword prediction, most of the work is done by extracting sequences directly from the source input or classifying them from predefined candidate lists, which cannot generate keywords that do not exist in the dataset label space. Inspired by the approach of generating keywords in scientific articles, the Seq2Seq framework was used to implement the generation of keywords on social media platforms. A split retrieval approach was used to generate keywords. The results of the classification method are aggregated with the results of the generation method based on the replication mechanism.

3.Methods

3.1.Model Structure

A set C is first defined with an input set of $|C|$ text-picture pairs $\{(\boldsymbol{x}^n, \boldsymbol{I}^n)\}_{n=1}^{|c|}$ of preschool programs, and the goal of this paper is to assess a set of labels $\boldsymbol{y}$ for each text-picture pair of preschool teachers' competencies. The source input pairs are replicated multiple times so that each input pair has a keyword. Each input pair is represented as a triple ($\boldsymbol{x}$, $\boldsymbol{I}$, $\boldsymbol{y}$), $\boldsymbol{x}$, $\boldsymbol{y}$ are word sequences for text content and for label content, where $\boldsymbol{I}$ denote the number of words in the word sequences $\boldsymbol{x}$, $\boldsymbol{y}$, respectively. Figure 2 shows the general framework of the proposed competency assessment model for multimodal labeled preschool teachers. The model runs from bottom-up: first, the text and images in the preschool program are encoded as text representations and image representations, and their complex semantic interactions are captured using a co-attentive mechanism; then the learned multimodal representation vector is used in a classification model or sequence generation model for labels, using an aggregation strategy to combine their outputs; Finally, the whole above framework can be jointly trained as a whole model by means of multi-task learning.

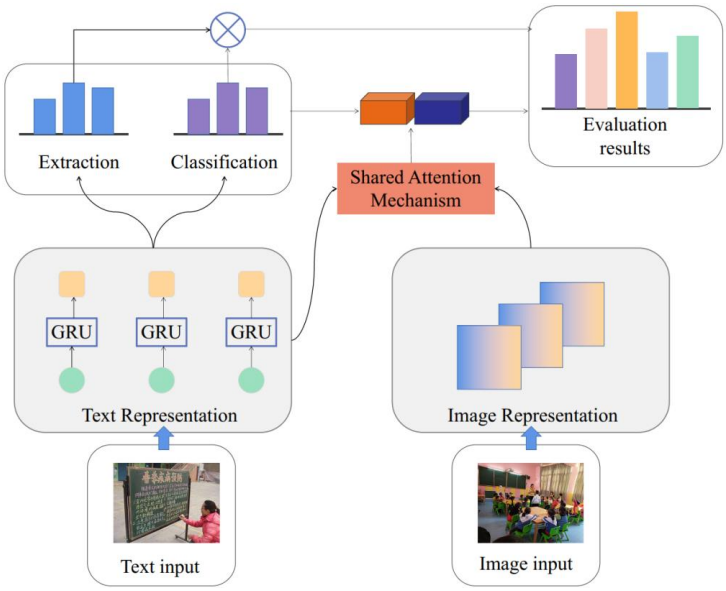

Figure 2 Model Structure

3.2.Multimodal coding

Learning text representation: first, each word x; in the text input sequence is embedded into a high-dimensional vector by means of a lookup table pre-trained by the dataset, and then the embedded word $e(x_i)$ is encoded using a bi-directional gated recurrent unit with the expression

$$\begin{aligned} \overrightarrow{\boldsymbol{h}}_i &= \mathrm{GRU}\left(e(x_i), \overrightarrow{\boldsymbol{h}}_{i-1}\right); \\ \overleftarrow{\boldsymbol{h}}_i &= GRU\left(e(x_i), \overleftarrow{\boldsymbol{h}}_{i+1}\right)_{\circ} \end{aligned} \tag{1}$$

Connect the forward hidden state $\overrightarrow{\boldsymbol{h}_i}$ and the backward hidden state $\overleftarrow{\boldsymbol{h}_i}$ into a vector, which is taken as the context-aware representation of x_i; in this paper, all hidden state in the input sequence is stored into a text vector library.

Learning image representation: 49 convolutional feature maps are extracted from each image $\boldsymbol{I}$ using the VGG-16 network pre-trained on the large-scale image library ImageNet, and each feature map is transformed into a new vector v by a linear projection layer, and then stored in an image vector library.

The fusion of multimodal contents in this paper uses a text-dominated co-attentive mechanism. This attention mechanism alternately generates picture attention and text attention in turn, as shown in Figure 3, and consists of three steps: summarizing the text representation vector into a single vector; computing picture attention based on the text summarization vector; and computing the attention of the text again based on the attention of the picture features. Specifically, the operation of calculating attention is $\hat{\boldsymbol{x}}$, and the calculated picture/text attention vector is output with the picture/text feature $\boldsymbol{X}$ and the attention guide $\boldsymbol{g}$ of the text/picture as the input, and the expression as:

$$\begin{aligned} \boldsymbol{H} &= \tanh\left(\boldsymbol{W}_x\boldsymbol{X} + \boldsymbol{W}_g\boldsymbol{g}\right); \\ \boldsymbol{\alpha}^x &= \operatorname{softmax}\left(\boldsymbol{\omega}_{hx}^{\mathrm{T}}\boldsymbol{H}\right); \\ \hat{\boldsymbol{x}} &= \sum \alpha_i^x x_{i\circ} \end{aligned} \tag{2}$$

Where: $\boldsymbol{W}_x$, $\boldsymbol{W}_g$, $\boldsymbol{\omega}_{hx}^{\mathrm{T}}$ are the feature matrix; α_i^x is the attention weight of feature $\boldsymbol{X}$.

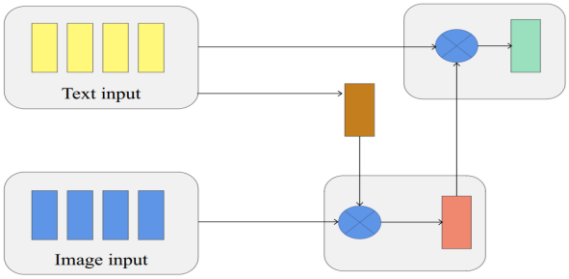

Figure 3 Common Attention Mechanism Structure

Considering the noise characteristics of the data, a maximum/average pooling layer is used to obtain an overall query vector for each modality, and then the output of all co-attentive layers is represented as a context vector by a linear multimodal fusion layer, which is fed into a label classification model and a label sequence generation model for the competency assessment of labeled preschool teachers.

3.3.Competency assessment model

An aggregation strategy is used to combine the classification and generation methods of multimodal labeled preschool teachers' competency assessment into a unified model of preschool teachers' competency assessment by combining the characteristics of different methods. Since each label $\boldsymbol{y}$ usually consists of only a few words, the words can be considered as discrete parts of the overall label and the competency assessment words of preschool teachers are used to preschool teachers' competency assessment labels. In the classification method, the multimodal context vector is passed directly into a two-layer multilayer perceptron MLP, which is then mapped to the distribution of the label classification vocabulary V as follows.

$$P_{\mathrm{cls}}(\boldsymbol{y}) = \operatorname{softmax}\left(MLP_{\mathrm{cls}}(\boldsymbol{c}_{\mathrm{fuse}})\right)_{\circ} \tag{3}$$

For label sequence generation, the Seq2Seq framework is used to generate a new label sequence y, where the generator probability is defined as:

$$\prod_{t=1}^{ly} = P(y_t \mid \boldsymbol{y} < t) \tag{4}$$

A one-way gated cyclic unit GRU decoder is used to model the generation process, specifically, the hidden state $\boldsymbol{s}_t$ released by the decoder is based on the previous hidden state and the input of the embedded decoder is initialized by the last hidden state of the text encoder. The contextual vector $\boldsymbol{c}_{\mathrm{text}}$ of the text is obtained using

the co-attentive mechanism.

$$\begin{aligned} \boldsymbol{c}_{\text{text}} &= \sum_{i=1}^{l_x} \alpha_{t,i} \boldsymbol{h}_i; \\ \alpha_{t,i} &= \text{softmax}\left(S(\boldsymbol{s}_t, \boldsymbol{h}_i)\right); \\ S(\boldsymbol{s}_t, \boldsymbol{h}_i) &= \boldsymbol{v}_\alpha^{\text{T}} \tanh\left(\boldsymbol{W}_\alpha[\boldsymbol{s}_t; \boldsymbol{h}_i] + \boldsymbol{b}_\alpha\right) \end{aligned} \tag{5}$$

where $S(\boldsymbol{s}_t, \boldsymbol{h}_i)$ is the score function to measure the compatibility between the *t*-th decoded word and the *i*-th word of the text encoder; $\boldsymbol{W}_\alpha$, $\boldsymbol{b}_\alpha$, and $\boldsymbol{v}_\alpha^{\text{T}}$ are all trainable weights. Next, a static multimodal vector c_{fuse} is combined to construct a rich contextual representation.

$$c_t = [u_t; s_t; c_{\text{text}} + c_{\text{fuse}}] \tag{6}$$

On this basis, another MLP with a SoftMax function is used to map c_t the word distribution of the generating vocabulary V_{gen}:

$$P_{\text{gen}}(y_t) = \text{softmax}\left(MLP_{\text{gen}}(c_t)\right) \tag{7}$$

To enable the decoder to better replicate words from the source input preschool program, the replication mechanism is applied to set an MLP soft switch with a sigmoid activation function, which determines whether the model generates word sequences from the vocabulary V_{gen} or extracts words from the source input sequence, where the probability distribution of extracting the source input sequence is determined by the text attention weight a1.

The output of the classification model is aggregated into the label sequence generation results using an extension of the replication mechanism: the first *K* predictions are retrieved from the classification model and transformed into word sequences, with l being the length of the combined predicted sequences; then their classification logarithms are normalized using the SoftMax function to a word-level distribution *β,* which represents the probability that the words will be extracted from the classification output.

4.EXPERIMENTS AND RESULTS

4.1.Experiment setup

The data in this paper are obtained from the internal non-public data of an early childhood education research institute in China, containing 53,701 data. In this paper, the data set data were randomly divided into training set, validation set, and test set according to 8:1:1. The data segmentation and statistical information of the dataset are shown in Table 1.

Table 1 Data segmentation and statistics of the dataset

Data sets	Number of posts	Average number of labels for teaching programs	Label Length
Training set	42959	1.33	1.85
Validation set	5370	1.34	1.85
Test set	5372	1.32	1.86

In this paper, a generative vocabulary with 45,000 words and a key phrase classification vocabulary Va1 with 4,262 labels is used to encode the text input using a 200-dimensional GloVe embedding. If the validation loss does not decrease, a maximum gradient with a magnitude of 5 is used. The gradient cropping method is used to attenuate it by 0.5. The early stop method is used by monitoring the change of the validation loss.

4.2 Experimental results

Table 2 Comparison of experimental results of each model

Models	F1@ 1	F1@ 3	MAP@ 5
TAKG	36.38	27.65	43. 49
COA	41.16	31.13	47. 44
GEN-CO-ATT	44.57	31.24	49.56
UNIFIED-CO-ATT	45.82	31.26	49.85

The comparison of experimental results for each model is shown in Table 2. The proposed unified preschool teacher's competency assessment model UNIFIED-CO-ATT had 9.44 percentage points higher F1 values than the unimodal-only comparison model TAKG; the proposed label sequence generation model GEN-CO-ATT had 8.19, 3.59, and 6.07 percentage points higher F1@1, F1@3, and MAP@5 compared to the TAKG model. The model considering multimodal content has better performance than the model considering only text modal content, which indicates that the Seq2Seq framework-based tag sequence generation model can make good use of the specificity of multimodal information on social media platforms, and the image modality provides many additional information not contained in the text modality. The proposed unified labeled preschool teacher's competency assessment model UNIFIED-CO-ATT has 1.25, 0.02, and 0.29 percentage point improvement over the GEN-CO-ATT model using only the generation method on F1@1, F1@3, and MAP@5, i.e., the unified labeled preschool teacher's competency assessment model performs better than the model using only the classification method.

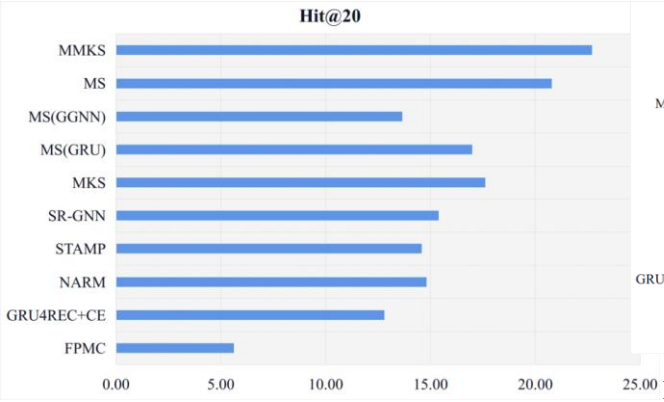

Figure 4 Comparison of Hit@20 performance of different algorithms

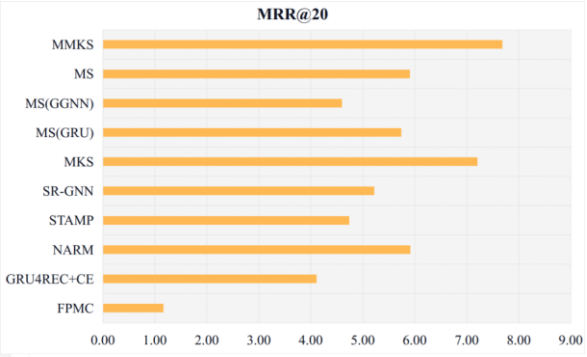

Figure 5 MRR@20 performance comparison of different algorithms

By comparing the performance of all models on different datasets for the competency assessment of teaching-based preschool teachers in Figure 4 and Figure 5, the experimental results show that the proposed model in this paper is very helpful for the performance improvement, outperforming all baselines in all datasets. The combined use of micro-behavioral operations and multimodal knowledge mapping can improve the performance of competency-based assessments for teaching preschool teachers. By introducing multimodal entities, text and visuals are added to the structured knowledge, which can greatly help to improve the performance of preschool teachers' competency assessment and is more friendly to multimodal information than some other approaches. Modeling instruction by learning item embeddings and learning operational embeddings separately is more effective than learning micro-behavioral embeddings directly. As mentioned earlier, the transformation patterns of item sequences are different from those of operational sequences, so combining item and micro-behavioral operations together is helpful for performance improvement to a certain extent, and the effectiveness of using micro-behavioral operations is proved to be significantly superior by the above experimental results.

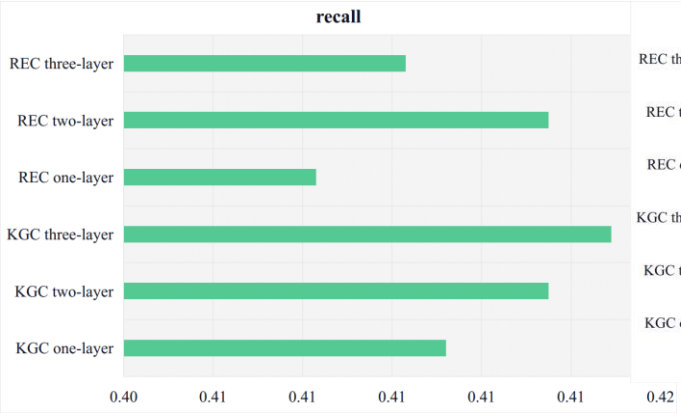

Figure 6 Recall impact of model depth

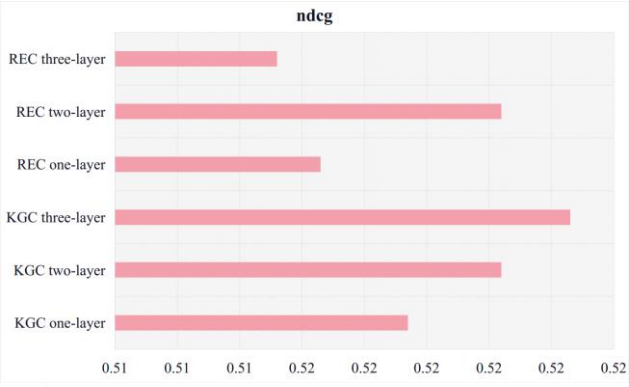

Figure 7 ndcg impact of model depth

To evaluate the effectiveness of layer stacking, experiments are conducted for different numbers of layers, and the number of layers is considered as the depth of the model. For the knowledge graph embedding part of this model, the number of multimodal knowledge graph attention layers is fixed as 2. The effects of different model depths (different number of multimodal knowledge graph attention layers) in knowledge graph embedding can be summarized as follows: in the KKBOX dataset, as the number of multimodal knowledge graph attention layers increases, the evaluation metrics increase, proving the effectiveness of domain information fusion in knowledge graph embedding; in the This may be due to the relative sparsity of multi-hop information in KDATA data. Combined with the results in Figure 6 and Figure 7, the proposed method (considering the information of adjacent entities when performing knowledge graph embedding) can provide higher quality entities compared with those methods that consider knowledge graph entity triples independently. embedding for preschool teachers' competency assessment. For the competency assessment component of preschool teachers, the assessment metrics grow first in both datasets as the number of model layers increases, which validates that knowledge graph embedding at different leap points is helpful for the competency assessment system of preschool teachers.

5.CONCLUSION

To promote the quality improvement of preschool education, we must pay attention to the quality and level improvement of kindergarten teachers' construction. With the current accelerated social development, the professional development of teachers is an important foundation for the growth of young children, and it is a basic need and fundamental requirement for the development of preschool education to focus on the professional development of kindergarten teachers and promote the assessment of their core competencies. In the assessment of kindergarten teachers' competence, we should pay attention to the special characteristics of kindergarten teachers' work, clarify the complexity and challenges of preschool education, grasp the existing problems in preschool education, study the basic path of kindergarten teachers' team competence assessment from the actual needs, promote the continuous improvement of kindergarten teachers' professionalism, and lay a good foundation for the quality improvement of preschool education.

In this paper, the competency assessment problem of preschool teachers is studied, and the performance of labeled sequence generation model in this problem is investigated, and a unified competency assessment model for labeled preschool teachers is further proposed, which combines the advantages of sequence generation model and classification model. In addition, the aggregation strategy used in this paper of jointly training individual models first and then aggregating the classification model results into the generative model results is effective. Experimental results on a large-scale dataset show that the model in this paper significantly outperforms models that use only text content generation labels and models that use only classification methods preschool teachers' competency assessment labels.

REFERENCE

[1] Zhao M, Chen C, Liu L, et al. Orbital collaborative learning in 6G space-air-ground integrated networks[J]. Neurocomputing, 2022, 497: 94-109.

[2] Chen C, Zeng Y, Li H, et al. A multi-hop task offloading decision model in MEC-enabled internet of vehicles[J]. IEEE Internet of Things Journal, 2022.

[3] Chen C, Li H, Li H, et al. Efficiency and Fairness Oriented Dynamic Task Offloading in Internet of Vehicles[J]. IEEE Transactions on Green Communications and Networking, 2022.

[4] Chen C, Jiang J, Zhou Y, et al. An edge intelligence empowered flooding process prediction using Internet of things in smart city[J]. Journal of Parallel and Distributed Computing, 2022, 165: 66-78.

[5] Chen C, Jiang J, Fu R, et al. An intelligent caching strategy considering time-space characteristics in vehicular named data networks[J]. IEEE Transactions on Intelligent Transportation Systems, 2021.

[6] Yun H C, Kim H S. Analyses of teacher efficacy and child rights-securing childcare depending on preschool teacher's team teaching experiences[J]. Korea Open Association for Early Childhood Education, 2019, 24(5):41-67.

[7] Chen C, Ahlqvist V H, Henriksson P, et al. Preschool environment and preschool teacher's physical activity and their association with children's activity levels at preschool[J]. PLoS ONE, 2020, 15(10):e0239838.

[8] Machynska N, Derkach Y, Pankevych Y. TYPES AND FORMS OF PROFESSIONAL DEVELOPMENT OF A PRESCHOOL TEACHER IN IN-SERVICE TRAINING[J]. Continuing Professional Education Theory and Practice, 2020(2):72-77.

[9] Toran M, Hacfazlolu Z. Dream versus reality: The process of preschool teacher's professionalization in Turkey[J]. Mediterranean Journal of Educational Research, 2020, 14(31):2020.

[10] Stancliff S. Improving Community-Based Preschool-Teacher Confidence to Create Motor-Enriched Classrooms[J]. The American journal of occupational therapy.: official publication of the American Occupational Therapy Association, 2020, 74(4_Supplement_1):7411515320p1.

[11] Lim J Y, Kim M J. A Study on Preschool Teacher"s Perception and the Actual Condition of Word Play[J]. Journal of Children s Literature and Education, 2020, 21(4):139-167.

[12] Rank A. Pdagogische Orientierungen zum Schriftspracherwerb von Fachkrften im Kindergarten (2006 und 2016)Preschool teacher's beliefs about early literacy in kindergarten (2006–2016)[J]. Zeitschrift für Grundschulforschung, 2020, 13(2).

[13] Hoffman J A, Schmidt E M, Arguello D J, et al. Online preschool teacher training to promote physical activity in young children: A pilot cluster randomized controlled trial[J]. School Psychology, 2020, 35(2).

[14] Ren L, Hu B Y, Wu H, et al. Differential associations between extracurricular participation and Chinese children's academic readiness: Preschool teacher–child interactions as a moderator[J]. Early Childhood Research Quarterly, 2022, 59:134-147.

[15] Rojas N M, Abenavoli R M. Preschool teacher-child relationships and children's expressive vocabulary skills: The potential mediating role of profiles of children's engagement in the classroom[J]. Early Childhood Research Quarterly, 2021, 56:225-235.

[16] Korepanova M V, Savva N V, Gushchina N A. Formation of auto-competence of a preschool teacher in the process of professional development[J]. SHS Web of Conferences, 2021, 113(4):00056.

[17] Bayrak H U. SWOT ANALYSIS OF DISTANCE EDUCATION BASED ON PRESCHOOL TEACHER CANDIDATES[J]. International Journal of Eurasian Education and Culture, 2021, 6(12):189-234.

[18] Inoue M, Inoue N. Effects of Behavioral and Functional Training on Japanese Preschool Teacher Knowledge and Child Behavior[J]. Journal of Positive Behavior Interventions, 2021(2):109830072199353.

[19] Toklu D A, Hursen C. Assessment of the Educational Needs of Preschool Teacher Candidates as regards Teaching Practice[J]. Revista romaneasca pentru educatie multidimensionala - Journal for Multidimensional Education, 2021, 13.

[20] Al H. Comics and Children's Literacy Skills: A Focus Group Analysis from Preschool Teacher's Perspective[J]. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 2021, 12(3):53-62.

[21] Laimīte Sekāne. PRESCHOOL TEACHER'S ATTITUDE TO ENTERPRISE IN PRESCHOOL INSTITUTION[J]. Education in A Changing Society, 2014, 1.

[22] Oncu E C, Unluer E. Environmental Views and Awareness of Preschool Teacher Candidates[J]. Procedia - Social and Behavioral Sciences, 2015, 174:2653-2657.

[23] Bateman A, Church A. Children's Knowledge-in-Interaction || Questions and Answers, A Seesaw and Embodied Action: How a Preschool Teacher and Children Accomplish Educational Practice[J]. 2017, 10.1007/978-981-10-1703-2(Chapter 3):37-56.

[24] Ignjacevic M S, Grujic G. COMPARATIVE ANALYSIS OF MUSIC EDUCATION SYLLABI WITHIN PRESCHOOL TEACHER TRAINING PROGRAMS IN SERBIA[J]. 2017(2).

[25] Qiu Y, Xiaotao L U, Taisheng F U. On the Benevolence Heart of the Preschool Teacher[J]. 2019(4).

[26] Chan H H, Kim M S. The Development and the Effect of A Preschool Teacher Training Program for Pretend Play Competence[J]. Korean Journal of Child Studies, 2015, 36(1):99-124.

[27] Gursimsek A I. Preschool Teacher Candidates' Pupil Control Ideology and Educational Beliefs[J]. tim Ve Bilim, 2014, 39(171):436-447.

[28] Suchodoletz A V, F?Sche A, Gunzenhauser C, et al. A typical morning in preschool: Observations of teacher–child interactions in German preschools[J]. Early Childhood Research Quarterly, 2014, 29(4):509-519.

[29] Baker-Henningham H. The Irie Classroom Toolbox: Developing a violence-prevention, preschool teacher-training programme using theory, evidence and practice[J]. Ann N Y Acad, 2018, 1419:179-200.

[30] Commodari E. Preschool teacher attachment, school readiness and risk of learning difficulties[J]. Early Childhood Research Quarterly, 2013, 28(1):123-133.